

REMARKS

We have carefully considered the Office Action dated May 2, 2006, in which all claims are rejected. In the Response to Amendment section of the Office Action the Examiner states that “it is noted that the features upon which the Applicant relies are not recited in the rejected claim.” As an example the Examiner states “Applicant’s contend ... ‘Fuoco does not teach or suggest generating and using parity check bits that are stored in a *separate* buffer location’ ...” (emphasis in original). We point out that claim 1 contains the following step

storing the data words in a plurality of buffer locations in the buffer memory and **the parity check bits in one or more buffer locations in the buffer memory following the buffer locations that contain the data;** (emphasis added).

which clearly recites the relied-upon feature that is not taught by Fuoco. Claim 1 also includes the step of

producing from the stored and regenerated parity bits a result that is usable **to directly identify the buffer location of a data code word that contains an erroneous bit** and the location of the erroneous bit in the data word contained in the identified buffer location. (emphasis added).

which is another clearly recited relied-upon feature that is not taught by Fuoco. As set forth in the prior response, there is no teaching or suggestion in Fuoco of producing such a result. Indeed, there is no teaching or suggestion in Fuoco of the claim 1 step of

applying data to be stored in a buffer memory **as a plurality of data words** to a generator matrix to generate parity check bits; (emphasis added).

Rather, Fuoco generates the check bits separately for each 4-byte data code word. See, Column 5, lines 29-54 and Table 1. As stated in Fuoco “the ECC logic will also calculate 7 check bits for each data code word.” Column 4, lines 5-6. See also Table 1 and Column 5, lines 29-54.

In particular, the Fuoco reference describes a system in which the respective address locations in the memory are 40 bits wide, and “each memory location ... stores a 4 byte data word, the associated 7 check bits and the flag bit for each data word.” Column 4, lines 6-9. See also, Column 3, lines 24-33; Column 5, lines 58-60. Thus, there can be no doubt that the Fuoco reference teaches storing the data and associated check bits in the *same* memory location, and that independent claim 1 quoted above as well as the remaining independent claims 23-28 respectively recite storing the parity bits **in buffer locations that follow the buffer locations in which the data are stored.**

The RAS, CAS WE, OE and ADDR signals to which the Examiner refers are discussed in Fuoco as being used for a conventional write operation in which an entire 4 byte data word is overwritten and also for a read-modify-write operation that involves overwriting only certain of the four bytes of a data word. Check bits are generated for the data word in either write operation and the check bits are stored in the same memory location as the data word. See, Column 4, lines 44-46 and 56-61; Column 8, lines 20 et seq.

In the read-modify-write operation, the row and column activation strobes, RAS and CAS respectively are used to properly produce the new data word and then encode the data code word, to produce the associated 7 check bits that will ultimately be stored in

the memory location with the 4 byte or 32 bit data word and the associated system flag, to file the 40 bit wide memory location. As described beginning at Column 7, line 60, when the entire word stored in a memory location is not to be overwritten, the word contained in the memory location is first read from that memory location, the data word is corrected as necessary using the check bits read from the same memory location, and the data word is then supplied to the data latch 52. The data supplied to the data latch 52 and the data bytes that are to be newly written, that is, the bytes that are to overwrite certain bytes of the retrieved data word, are supplied to the multiplexer 40, which is activated by the CAS signal. The multiplexer multiplexes the new data bytes with the data bytes stored in the data latch, to form the new four byte data word that is to be written to the memory location. This new four byte data word is provided through the selector 42 to the check bit generator 44, which generates the new seven check bits, which are then written to the memory location that contains the new data word. See, Column 8, lines 15-20.

Thus, Fuoco clearly states that the data word and the associated check bits are stored in the *same memory location*, whether the check bits are generated during a conventional write operation or during a read-modify-write operation generally. See, Column 4, lines 56 - Column 5, lines 57; also Column 5, lines 58-59.

There is thus no teaching or suggestion in Fuoco that the check bits are stored in “one or more buffer locations in the buffer memory **following the buffer locations that contain the data**,” as is stated in claim 1 (emphasis added). Further, the Fuoco system clearly does not perform the step of producing from the stored and regenerated parity or check bits a result that is “usable to directly identify the buffer location of a data word

that contains an erroneous bit” (quoting claim 1). The Fuoco system uses check bits that apply to a single data word, and only the single data word is used to regenerate the check bits that are used along with the stored check bits in the error detection and correction operations. As discussed, the data word and the stored check bits are stored in and read from the *same* location. See, e.g., Column 5, lines 58 et seq. Thus, there is no need in Fuoco to specify through the error detection and correction operations the buffer location in which the data word that contains errors is stored, since the Fuoco system by definition knows the location of the data code word.

As discussed above, the invention of claim 1 operates in a completely different manner, it generates the parity bits by encoding together “a plurality of data words” (quoting from claim 1). The data words are then stored “in a plurality of buffer locations in the buffer memory” (quoting claim 1). The parity bits, which correspond to the plurality of data words are stored “in one or more buffer locations in the buffer memory following the buffer locations that contain the data.” (quoting claim 1) The stored data, i.e., the plurality of data words, and the parity check bits are read from their respective memory locations, and the plurality of data words are again encoded to regenerate the parity bits. The stored and regenerated parity bits, which apply to the “plurality of data words” (see first paragraph of the claim 1), are then manipulated to produce the result that is “useable to directly identify the buffer location of a data word that contains an erroneous bit” (quoting claim 1) i.e., the location that contains one of the plurality of data words that comprises the data of claim 1.

The Examiner in rejecting claim 3 and (cancelled) claim 4 states that the Fuoco “substantially teaches ... the address locations in the add-on memory are assumed to be 40 bits wide and the data words are written as 4 bit strings with 7 check bits generated thus accounting for the 39 of the possible 40 bits in each address” (Office Action page 6). Accordingly, the Examiner **agrees** that each data word and its associated check bits are stored in the same address location, that is, in the same location in memory in the Fuoco system. This is in total contrast to claim 1, from which claim 3 depends. While the quotation from Fuoco does not pertain to the limitation added by claim 3, we again point out that Fuoco has no need to produce as a result of the comparison of the stored and regenerated check bits information that identifies a particular buffer location that contains a data word with one or more erroneous bits. In the Fuoco system, the data word and the associated check bits that are used during the error detection and correction are read from the *same* memory location and thus, the address of the data word is by definition known.

Claims 5 and 6 add a limitation relating to the generator matrix that is used to encode the plurality of data words. As specifically stated in claim 5, the parity check generation portion of the generator matrix **“comprises rows of bits corresponding to binary representations of the buffer locations used to store the data.”** There is no teaching or suggestion of this in Fuoco. Rather, Fuoco describes the generation of the check bits using a table that illustrates how the bits of a single data word participate in the encoding. See, Table 1 in Column 5 and 6 of Fuoco. As can be seen from Table 1, there is no teaching or suggestion of a generator matrix in which the parity check generation portion “comprises rows corresponding to binary representations of the buffer locations

used to store the data” (quoting claim 5). Indeed, if such a matrix were used in Fuoco, the matrix would have to change for each data word - since each data word is **separately** encoded.

We do not specifically address the Examiner’s rejections of the remaining claims that depend from claim 1. This should not be construed as acquiescence to the rejections, but as recognition that the rejections are moot based on our remarks regarding the allowability of the independent claims and the discussion of dependent claims 2-6. However, we point out with respect to claim 12, that the Examiner has correctly stated, in his rejection of claim 4, that the Fuoco system “corrects single bit errors.” See, also, Column 5, lines 38-39. The syndrome decode logic of the Fuoco system also detects multiple bit errors but cannot correct them. See, Column 6, lines 29-33. Accordingly, the Fuoco system does not teach “**identifying the locations of two erroneous bits of the data code word,**” as is explicitly stated in claim 12, and which necessarily results in the correction of the two bits by flipping the bits.

The discussion above applies also to the remaining method and apparatus claims. Specifically, there is no teaching or suggestion in the Fuoco patent of a method that indicates the step of: “**applying data ... to a generator matrix as a *plurality* of data words to generate parity check bits.**” (quoting claim 23 emphasis added). Further there is no teaching in Fuoco of a generator matrix “**comprising a data portion and a parity check generation portion, and the parity check generation portion *comprises rows of bits corresponding to binary representations of the respective buffer locations to be used to store the data words.***” (quoting claim 23 emphasis added). In addition,

there is no teaching in Fuoco of **“storing the parity bits in a location of the buffer memory *following* the locations that contain the data.”** (quoting claim 23 emphasis added). Rather, as discussed above and in the Office Action, Fuoco describes a memory in which a four-byte data word and the 7 check bits generated by the encoding of the data word are stored in the same memory location. See, Column 3, lines 28-34; Column 4, lines 6-9; Column 5, lines 58-60, Office Action, page 6. Thus, there can be no question that the encoding method of claim 23 is not taught or suggested by the Fuoco patent.

Further, the data storage system and the apparatus of independent claims 24 and 26 include controllers that are operable to perform the steps of claim 1, and thus, the discussion as to the lack of teaching by Fuoco of particular steps of claim 1 applies equally to these claims. Similarly, the data storage system and the apparatus of claims 25 and 27 includes a controllers that are operable to perform the steps in claim 23 and the discussion of the lack of teaching by Fuoco as to particular steps of claim 23 applies equally to these claims.

We believe that the discussion set forth above, which relies specifically on the language of the pending claims, shows that the invention as set forth in the claims is not taught or suggested by Fuoco. In light of the above, we ask that the Examiner reconsider the rejections and issue a Notice of Allowance for all pending claims, as amended to correct an omitted dependency in claim 21.

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Respectfully submitted,

A handwritten signature in cursive script, reading "Patricia A. Sheehan". The signature is written in dark ink and is positioned above the printed name.

Patricia A. Sheehan

Reg. No. 32,301

CESARI AND MCKENNA, LLP

88 Black Falcon Avenue

Boston, MA 02210-2414

(617) 951-2500